IN THE CLAIMS:

This listing of claims replaces all prior versions, and listings, of the claims in the application:

1. (Previously Presented) A method for performing a plasma-assisted treatment on a substrate in a reactor chamber, comprising:

introducing a first process gas into the reactor chamber during a first time period and introducing a second process gas having a different composition than the first process gas during a second time period which follows the first time period;

creating a plasma within the reactor chamber by establishing an RF electromagnetic field within the chamber and allowing the field to interact with the first and second process gases; and

causing the electromagnetic field to have an energy level which varies cyclically between at least two values each sufficient to maintain the plasma, such that each energy level value is associated with performance of a respectively different treatment process on the substrate.

2. (Original) The method according to claim 1 wherein, in said step of causing, the energy level of the electromagnetic field is caused to vary according to a non-square wave function.

3. (Original) The method according to claim 1 wherein, in said step of causing, the energy level of the electromagnetic field is caused to vary according to a sinusoidal, ramp, or stepped function.

4. (Original) The method according to claim 1 wherein, in said step of causing, the energy level of the electromagnetic field is caused to vary among at least three values each sufficient to maintain the plasma.

5. (Original) The method according to claim 1 wherein, in said step of causing, the energy level of the electromagnetic field is caused to vary periodically with respectively different repetition periods during respectively different time intervals.

6. (Original) The method according to claim 1 further comprising maintaining a cyclically varying gas pressure in the process chamber.

7. (Canceled)

8. (Previously Presented) The method according to claim 1 further comprising withdrawing substantially the entirety of one of the process gases which has been previously introduced from the reactor chamber before introducing the other one of the process gases into the reactor chamber.

9. (Original) The method according to claim 8 wherein said step of causing the electromagnetic field to vary cyclically is carried out for causing the energy level to have a first one of the two values during a major portion of the first time period and a second one of the two values during a major portion of the second time period.

10. (Original) The method according to claim 9 wherein said steps of introducing a first process gas and introducing a second process gas are repeated in a cyclic manner.

11. (Original) The method according to claim 10 wherein each time period has a duration of less than 100 msec.

12. (Original) The method according to claim 11 wherein the substrate is a wafer mounted on a chuck and further comprising applying an RF bias voltage to the chuck.

13. (Original) The method according to claim 12 wherein said step of applying an RF bias voltage comprises varying the RF bias voltage cyclically between two values.

14. (Original) The method according to claim 13 wherein the RF bias voltage is varied in synchronism with cyclic variations of the RF field intensity.

15. (Original) The method according to claim 10 wherein, in said steps of introducing a first process gas and introducing a second process gas, each process gas is introduced at a flow rate which varies according to a non-square wave function.

16. (Original) The method according to claim 10 wherein, in said steps of introducing a first process gas and introducing a second process gas, each process gas is introduced at a flow rate which varies according to a sinusoidal, ramp, or stepped function.

17. (Previously Presented) The method according to claim 1 further comprising introducing at least a third process gas having a different composition than each of the first and second process gasses during a third time period which follows the second time period.

18. (Previously Presented) The method according to claim 1 further comprising maintaining a cyclically varying gas pressure in the process chamber.

19. (Previously Presented) A reactor for performing a plasma-assisted treatment on a substrate, said reactor comprising:

a chamber enclosing a plasma region;

a gas injection assembly immediately proximate the plasma region, said gas injection assembly configured to introduce a first process gas into said chamber during a first time period and introduce a second process gas having a different composition than the first process gas during a second time period which follows the first time period;

an RF source power supply configured to create an RF electromagnetic field in the plasma region, which field interacts with at least one of the first and second process gases to create a plasma, the field having an energy level which varies cyclically between at least two values each sufficient to maintain the plasma;

a support member configured to support the substrate in the chamber in communication with the plasma region; and

a vacuum pump communicating with the plasma region, said vacuum chamber adapted to withdraw process gas at a rate to maintain a selected vacuum pressure in the plasma region.

20. (Previously Presented) The reactor according to claim 19 further comprising: an RF bias power supply operatively connected to the substrate member and being configured to generate a direct current (DC) self-bias to attract ions to the substrate, the DC self-bias having an energy level which varies cyclically between at least two values.

21. (Previously Presented) The reactor according to claim 27 wherein said plurality of valve controllers are operative to introduce said first and second process gases into said chamber in the form of pulses.

22. (Previously Presented) The reactor according to claim 27 wherein each of said plurality of gas injection valves is an electromagnetic or piezo-electric device.

23. (Previously Presented) The reactor according to claim 27 wherein each of said plurality of gas injection valves is connected to supply gas to a single respective one of said plurality of gas injection nozzles.

24. (Previously Presented). The reactor according to claim 27 wherein each of said plurality of gas injection valves is connected to supply gas to a respective plurality of said plurality of gas injection nozzles.

25. (Previously Presented) The reactor according to claim 27 wherein each of said plurality of gas injection nozzles is a supersonic injection nozzle.

26. (Previously Presented). The reactor according to claim 27 wherein said gas injection plate is further provided with a plurality of exhaust orifices through which the first or second process gas flows from said plasma region to said vacuum pump.

27. (Previously Presented) The reactor according to claim 19 wherein said gas injection assembly comprises:

a gas injection plate provided with a plurality of gas injection nozzles;

a plurality of gas injection valves, each configured to supply at least one of the first or second process gases to at least one respective one of said nozzles; and

a plurality of valve controllers coupled to said plurality of gas injection valves to cause the first or second process gas to be supplied to each of said nozzles in an intermittent manner.